Microstructure at the Growth Edge of Red Abalone Shell

E. DiMasi (BNL) and M. Sarikaya (U. of Washington)

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Like many other biomineralized materials, nacre (mother-of-pearl) has a complicated, hierarchical microstructure with organization on length scales ranging from Ångstroms to microns. For example, the nacre of Red Abalone (Haliotis rufescens) is composed of bricks of aragonite ($CaCO_3$) "mortared" in an organic composite. The crystallography of the mineral component has been studied by electron microscopy techniques [1], but many questions remain. In particular, the structure and function of the organic component is not understood, especially near the growth edge of the shell where the aragonite platelets are nucleating. Our preliminary x-ray diffraction measurements of abalone shell near and away from the growth edge suggest that these regions may have a different aragonite mosaic. We also see some suggestion of an amorphous structure factor indicating a near-neighbor length scale of about 2.4 Å, which may be attributable to the organic material. If these results are confirmed by further studies, they will comprise the first direct structural information regarding nacre's organic component.

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References: [1] "Nacre of Abalone Shell: a Natural Multifunctional Nanolaminated Ceramic-Polymer Composite Material", M. Sarikaya and I. A. Aksay, in: *Results and Problems in Cell Differentiation* 19 (1992) 1 (S. T. Case, Ed., Springer-Verlag Berlin Heidelberg 1992).